QB
4
.U3

UNITED STATES NAVAL OBSERVATORY

CIRCULAR NO. 109

U. S. Naval Observatory, Washington, D. C. 20390 August 6, 1965

Annular Solar Eclipse of 20 May 1966

by

Julena S. Duncombe

U.S. NAVAL OBSERVATORY
JAN 19 1966
LIBRARY

GENERAL INFORMATION

The path of the annular phase of the eclipse of 20 May 1966 touches the earth at sunrise in the Atlantic Ocean off the coast of Africa. It enters Africa at 8^h01^m U.T. and continues in a northeasterly direction leaving Africa at approximately 9^h05^m U.T. Crossing the Mediterranean Sea it passes over the southeastern coast of Greece between 9^h26^m U.T. and 9^h34^m U.T. It passes over Turkey between 9^h41^m U.T. and 9^h49^m U.T.

Central eclipse occurs over the Black Sea at $9^h51^m.1$ U.T. at latitude $+41^\circ 33'.2$, longitude $-31^\circ 18'.9$. The path of the annular phase passes over the southern part of the U.S.S.R. from 10^h08^m U.T. until approximately 11^h08^m U.T. when it begins crossing China. The eclipse leaves the earth at sunset in eastern China.

Partial phases of the eclipse will be visible over all of Europe and most of Asia and the northern part of Africa.

The predictions in this *Circular* are derived from the basic data given in the American Ephemeris and Nautical Almanac for the Year 1966. The arguments are given in Universal Time, and the longitudes west of the Greenwich meridian are positive. The value of ΔT used in the computations is 36 seconds.

In the local circumstances the angle P is the position angle of the point of contact, measured eastward from the north point of the solar limb, and the angle V is the position angle of the point of contact, measured eastward from the vertical circle.

The circumstances of the eclipse were plotted by the Nautical Almanac Office on portions of the Air Navigation Charts Series V30 of the United States Oceanographic Office. The climatological data were compiled by Edward M. Brooks.

This *Circular* contains the following information: The Climatological Data for May, p. 3; The Eclipse Map from the American Ephemeris and Nautical Almanac, p. 4; The Path of the Annular Phase, p. 5; The Central Line, Duration and Width of Path at 10,000 feet, 20,000 feet, 30,000 feet, and 40,000 feet, pp. 6,7; The Central Line, Duration and Width of Path at 100 km, 200 km, and 300 km, pp. 8,9; Local Circumstances for Points on the Central Line, pp. 10,11; Local Circumstances for Geographic Locations for both Annular and Partial Phase, pp. 12,13; Maps of Portions of the Path, and of the Entire Path, pp. 14 through 25.

CLIMATOLOGICAL DATA FOR MAY

Geographic Locations	Lat.	Long.	Alt.	Mean Temp.	Mean Relative Humidity*	Mean Cloud Am't*	Number of Days Clear	Cloudy	Fog	Precip.*	Mean Precip.	Possible Dusty Sky
Sierra Leone	°	°	ft	F. °	%						in	
Freetown	+ 8.5	+ 13.2	37	82	(74)	.6				15	6.3	
Mali												
Tombouctou	+16.8	+ 3.0	886	94		.2					0.2	X
Algeria												
In Salah	+27.3	- 2.4	919	85		.1						X
Libya												
Tripoli	+32.9	- 13.2	72	68	67	.27	11	5	≤2	3	0.2	X
Misratah	+32.4	- 15.1	19	72	(59)	(.37)	12	3	≤1	(1)	0.2	X
Sirte	+31.2	- 16.6	70	71	(65)	(.23)	15	2	≤0.8	(1)	0.1	X
Greece												
Kalamai	+37.0	- 22.1	13	71			10	3				X
Sparta	+37.1	- 22.4	705	68	59	.42				8	1.9	X
Tripolis	+37.5	- 22.4	2,170	63	62	.33				10	2.2	X
Nauplia	+37.6	- 22.8	23	68	65	.52	10	2		6	1.0	X
Khalkis	+38.5	- 23.6	39				8	2				X
Athinai	+38.0	- 23.7	351	69	60	.40	6	3	0	7	0.8	X
Skiros	+38.9	- 24.6	394	65	(62)	(.32)	14	2	0.1	(2)	1.0	X
Andros	+37.8	- 24.9	144	69	64	.32	12	2		4	1.1	X
Khios	+38.4	- 26.2	23	68	(56)	(.44)			0.0	(2)	0.6	
Turkey												
Canakkle	+40.1	- 26.4	148	63	70	(.45)	9	4	0.2	(4)	1.0	
Mytilini	+39.1	- 26.6	72	67	(57)	(.40)	10	3	0.0	(3)	1.1	
Izmir	+38.4	- 27.2	10	69	61	(.46)	9	5	0.0	(3)	1.1	
Tekirdag	+41.0	- 27.5	179				4	7				
Istanbul	+41.0	- 29.0	374	61	62	.47	7	6	9	5	1.4	
Sile	+41.2	- 29.6	82				2	9				
Zongulak	+41.4	- 31.8	138	59	79	(.59)	5	8	4	(7)	2.0	
U.S.S.R.												
Novorossiysk	+44.7	- 37.5	122	61	73	.60	4	8	3	8	1.7	
Tuapse	+44.1	- 39.1	164				6	7				
Sochi	+43.6	- 39.8	256	61	(71)	.52	5	9	4	10	2.6	
Stavropol	+45.1	- 42.0	185	56	72	.51	7	7		14	2.8	
Astrakhan	+46.4	- 48.0	-46	64	59	.46	8	5		4	0.6	
Irgiz	+48.6	- 61.2	422	62	44	.37	9	2		4	0.7	
Aral More	+46.8	- 61.8	187	63		.32				4	0.4	
Kasalinsk	+45.8	- 62.1	160	66		.29	14	3		3	0.5	
China												
Kopal	+45.2	- 79.0	4,060	57		.51					1.9	X
Urumchi	+43.8	- 87.6	2,972	62		.32					1.2	X
Lukchun	+42.8	- 89.8	49	75		.51						X
Peking	+39.9	-116.4	125	68	53	.43	3			6	1.3	X
Tsinan	+36.7	-117.0	154	71	52	.51	8	8	0.2	5	1.4	
Tientsin	+39.2	-117.2	13	67	54	.42	10	5	0.3	3	1.1	

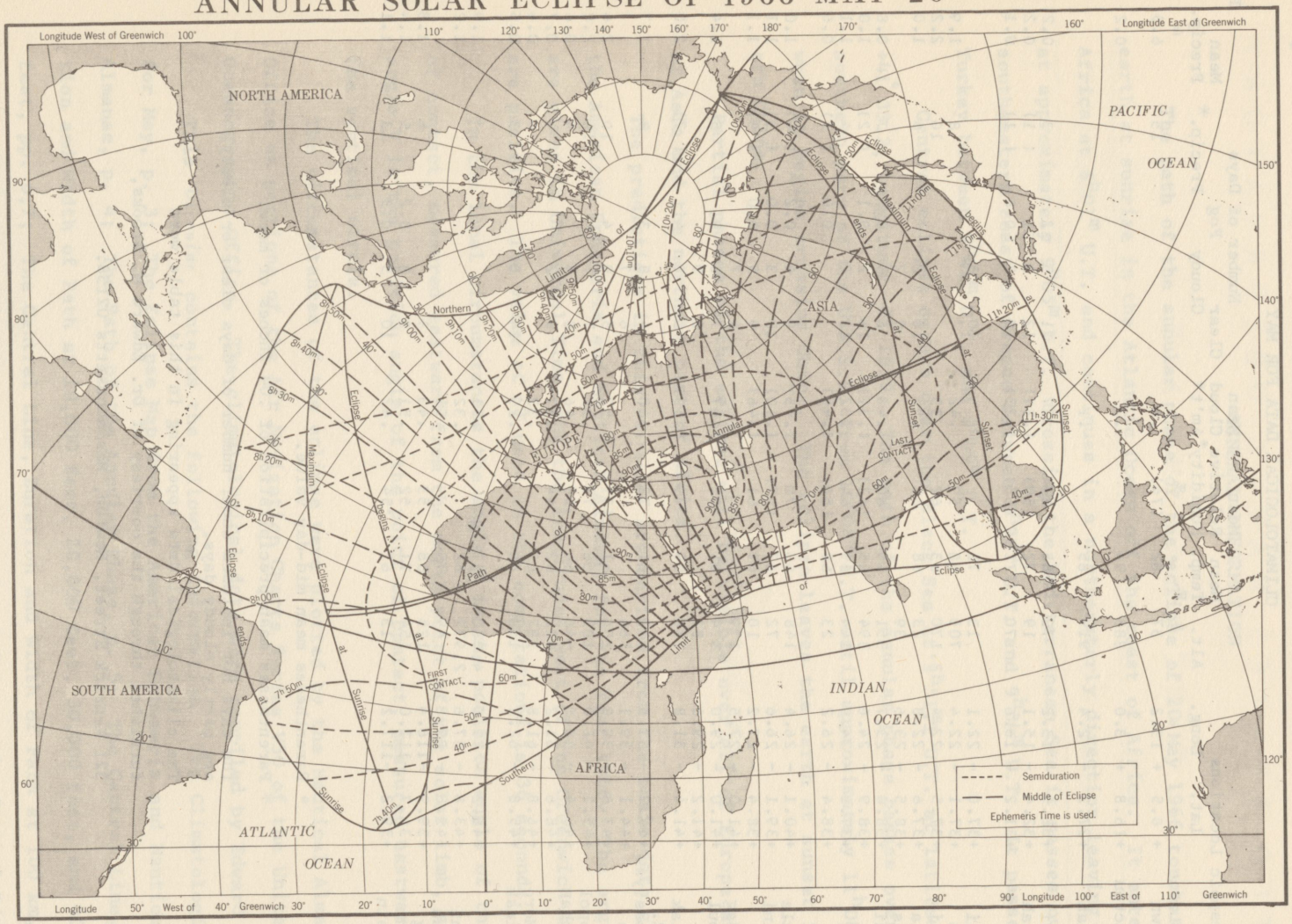
* Parentheses mean mid-day value.

* Parentheses mean precipitation of .04 inches or more.

The days not included under number of days clear or cloudy are partly cloudy days.

The climatological data appearing in this table were furnished through the courtesy of Dr. Edward M. Brooks, 321 Kenrick Street, Newton, Massachusetts 02158.

ANNULAR SOLAR ECLIPSE OF 1966 MAY 20



PATH OF THE ANNULAR PHASE

Universal Time	Northern Limit		Central Line		Southern Limit	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
h m	° ′	° ′	° ′	° ′	° ′	° ′
Limit	+ 2 07	+ 30 15	+ 1 52	+ 30 05	+ 1 36	+ 29 56
7 54	.. .. .	... .. .	.. .. .	... .. .	2 43.8	27 01.1
55	4 19.4	24 35.9	4 28.0	23 36.1	4 34.1	22 44.3
56	5 39.6	21 34.5	5 41.7	20 55.1	5 43.1	20 18.4
57	6 39.9	19 27.9	6 39.6	18 56.7	6 39.1	18 27.0
58	7 31.1	17 46.2	7 29.6	17 19.7	7 28.0	16 54.2
8 00	+ 8 58.3	+ 15 03.1	+ 8 55.6	+ 14 42.2	+ 8 53.0	+ 14 21.9
02	10 13.5	12 51.5	10 10.3	12 34.1	10 07.2	12 16.9
04	11 21.2	10 59.4	11 17.8	10 44.3	11 14.5	10 29.4
06	12 23.6	9 20.8	12 20.1	9 07.5	12 16.6	8 54.3
08	13 21.9	7 52.2	13 18.4	7 40.3	13 14.9	7 28.4
8 10	+14 17.1	+ 6 31.3	+14 13.6	+ 6 20.5	+14 10.2	+ 6 09.8
15	16 24.3	3 33.8	16 21.0	3 25.2	16 17.8	3 16.7
20	18 20.3	+ 1 01.2	18 17.3	+ 0 54.2	18 14.3	+ 0 47.2
25	20 08.1	- 1 14.6	20 05.4	- 1 20.4	20 02.7	- 1 26.1
8 30	+21 49.5	- 3 18.4	+21 47.1	- 3 23.2	+21 44.6	- 3 27.9
35	23 25.6	5 13.4	23 23.5	5 17.3	23 21.3	5 21.3
40	24 57.3	7 01.9	24 55.4	7 05.1	24 53.5	7 08.4
45	26 25.2	8 45.5	26 23.5	8 48.2	26 21.9	8 50.8
50	27 49.6	10 25.8	27 48.2	10 27.9	27 46.8	10 30.1
55	29 11.0	12 03.6	29 09.8	12 05.3	29 08.6	12 07.1
9 00	+30 29.6	- 13 40.0	+30 28.6	- 13 41.4	+30 27.6	- 13 42.8
05	31 45.5	15 15.8	31 44.7	15 16.9	31 43.9	15 17.9
10	32 58.9	16 51.7	32 58.3	16 52.5	32 57.7	16 53.2
15	34 09.9	18 28.2	34 09.5	18 28.8	34 09.0	18 29.4
20	35 18.6	20 06.1	35 18.3	20 06.5	35 17.9	20 06.9
25	36 25.0	21 45.8	36 24.7	21 46.1	36 24.5	21 46.3
9 30	+37 29.0	- 23 27.9	+37 28.9	- 23 28.1	+37 28.7	- 23 28.3
35	38 30.8	25 13.0	38 30.7	25 13.1	38 30.6	25 13.2
40	39 30.1	27 01.6	39 30.0	27 01.7	39 29.9	27 01.7
45	40 27.0	28 54.2	40 26.9	28 54.2	40 26.8	28 54.3
50	41 21.3	30 51.3	41 21.2	30 51.4	41 21.1	30 51.5
55	42 12.9	32 53.6	42 12.7	32 53.7	42 12.5	32 53.8
10 00	+43 01.6	- 35 01.6	+43 01.3	- 35 01.7	+43 01.1	- 35 01.9
05	43 47.2	37 15.9	43 46.8	37 16.0	43 46.4	37 16.2
10	44 29.6	39 37.1	44 29.0	39 37.3	44 28.4	39 37.5
15	45 08.3	42 05.9	45 07.5	42 06.2	45 06.7	42 06.4
20	45 43.1	44 43.1	45 42.0	44 43.3	45 40.9	44 43.5
25	46 13.5	47 29.5	46 12.1	47 29.6	46 10.7	47 29.8
10 30	+46 39.0	- 50 26.0	+46 37.3	- 50 25.9	+46 35.5	- 50 25.9
35	46 59.2	53 33.5	46 57.0	53 33.3	46 54.7	53 33.0
40	47 13.1	56 53.5	47 10.4	56 52.8	47 07.8	56 52.1
45	47 20.1	60 27.4	47 16.8	60 26.1	47 13.6	60 24.8
50	47 18.8	64 17.4	47 15.0	64 15.2	47 11.2	64 13.1
55	47 07.8	68 26.2	47 03.4	68 22.9	46 59.0	68 19.6
11 00	+46 44.9	- 72 58.4	+46 39.8	- 72 53.4	+46 34.8	- 72 48.5
05	46 06.6	78 01.1	46 01.0	77 53.7	45 55.4	77 46.4
10	45 07.3	83 47.5	45 01.3	83 36.5	44 55.3	83 25.7
11 12	+44 35.3	- 86 23.8	+44 29.2	- 86 10.8	+44 23.2	- 85 58.0
14	43 56.8	89 14.9	43 50.8	88 59.3	43 44.9	88 44.0
16	43 09.5	92 26.4	43 03.8	92 07.2	42 58.2	91 48.4
18	42 09.1	96 09.3	42 04.3	95 44.5	41 59.5	95 20.5
11 20	+40 45.5	-100 49.8	+40 43.3	-100 14.4	+40 40.8	- 99 40.8
21	39 45.8	103 56.2	39 47.0	103 09.1	39 47.3	102 25.8
22	38 09.7	108 38.2	38 23.6	107 13.8	38 32.3	106 05.2
Limit	+36 15	-113 56	+36 01	-113 44	+35 48	-113 33

CENTRAL LINE OF ANNULAR ECLIPSE

Universal Time	10,000 Feet		20,000 Feet		30,000 Feet		40,000 Feet	
h m	Latitude ° ′	Longitude ° ′	Latitude ° ′	Longitude ° ′	Latitude ° ′	Longitude ° ′	Latitude ° ′	Longitude ° ′
7 54	.. .. .	... .. .	+ 2 24.2	+ 28 32.8	+ 2 40.2	+ 27 48.7	+ 2 52.1	+ 27 15.8
55	+ 4 32.3	+ 23 24.0	4 36.5	23 12.2	4 40.5	23 00.7	4 44.5	22 49.6
56	5 44.6	20 46.7	5 47.6	20 38.3	5 50.4	20 30.1	5 53.3	20 22.0
57	6 42.0	18 49.9	6 44.3	18 43.1	6 46.7	18 36.3	6 48.9	18 29.6
58	7 31.6	17 13.8	7 33.6	17 07.9	7 35.5	17 02.1	7 37.5	16 56.3
8 00	+ 8 57.2	+ 14 37.4	+ 8 58.7	+ 14 32.7	+ 9 00.3	+ 14 27.9	+ 9 01.8	+ 14 23.2
02	10 11.6	12 29.9	10 12.9	12 25.8	10 14.2	12 21.7	10 15.5	12 17.6
04	11 18.9	10 40.7	11 20.0	10 37.0	11 21.1	10 33.4	11 22.2	10 29.7
06	12 21.0	9 04.2	12 22.0	9 00.8	12 22.9	8 57.5	12 23.9	8 54.2
08	13 19.2	7 37.2	13 20.1	7 34.1	13 20.9	7 31.1	13 21.8	7 28.1
8 10	+14 14.3	+ 6 17.7	+14 15.1	+ 6 14.8	+14 15.8	+ 6 12.0	+14 16.6	+ 6 09.2
15	16 21.6	3 22.8	16 22.1	3 20.4	16 22.7	3 17.9	16 23.2	3 15.5
20	18 17.7	+ 0 52.0	18 18.1	+ 0 49.9	18 18.5	+ 0 47.7	18 19.0	+ 0 45.6
25	20 05.7	- 1 22.3	20 06.0	- 1 24.2	20 06.3	- 1 26.2	20 06.6	- 1 28.1
8 30	+21 47.3	- 3 24.9	+21 47.5	- 3 26.7	+21 47.7	- 3 28.4	+21 47.8	- 3 30.2
35	23 23.6	5 18.9	23 23.7	5 20.5	23 23.8	5 22.1	23 23.9	5 23.7
40	24 55.5	7 06.6	24 55.5	7 08.0	24 55.5	7 09.5	24 55.6	7 11.0
45	26 23.5	8 49.5	26 23.5	8 50.9	26 23.4	8 52.2	26 23.4	8 53.6
50	27 48.1	10 29.1	27 48.0	10 30.4	27 47.9	10 31.6	27 47.8	10 32.9
55	29 09.7	12 06.5	29 09.5	12 07.6	29 09.4	12 08.7	29 09.2	12 09.9
9 00	+30 28.4	- 13 42.4	+30 28.2	- 13 43.5	+30 27.9	- 13 44.5	+30 27.7	- 13 45.5
05	31 44.4	15 17.8	31 44.2	15 18.8	31 43.9	15 19.7	31 43.6	15 20.6
10	32 58.0	16 53.3	32 57.7	16 54.2	32 57.3	16 55.0	32 57.0	16 55.9
15	34 09.1	18 29.6	34 08.7	18 30.3	34 08.4	18 31.1	34 08.0	18 31.8
20	35 17.8	20 07.1	35 17.4	20 07.8	35 17.0	20 08.5	35 16.6	20 09.1
25	36 24.3	21 46.6	36 23.8	21 47.2	36 23.4	21 47.8	36 22.9	21 48.3
9 30	+37 28.4	- 23 28.6	+37 27.9	- 23 29.0	+37 27.4	- 23 29.5	+37 26.9	- 23 30.0
35	38 30.1	25 13.5	38 29.6	25 13.9	38 29.0	25 14.2	38 28.5	25 14.6
40	39 29.4	27 01.9	39 28.9	27 02.2	39 28.3	27 02.4	39 27.7	27 02.7
45	40 26.3	28 54.4	40 25.7	28 54.5	40 25.1	28 54.7	40 24.5	28 54.8
50	41 20.5	30 51.4	41 19.9	30 51.5	41 19.3	30 51.5	41 18.6	30 51.5
55	42 12.0	32 53.6	42 11.4	32 53.5	42 10.7	32 53.4	42 10.0	32 53.3
10 00	+43 00.6	- 35 01.5	+43 00.0	- 35 01.3	+42 59.3	- 35 01.0	+42 58.6	- 35 00.8
05	43 46.1	37 15.7	43 45.4	37 15.3	43 44.7	37 14.9	43 44.0	37 14.5
10	44 28.3	39 36.8	44 27.5	39 36.2	44 26.8	39 35.7	44 26.1	39 35.1
15	45 06.7	42 05.4	45 06.0	42 04.7	45 05.3	42 04.0	45 04.5	42 03.3
20	45 41.2	44 42.4	45 40.5	44 41.5	45 39.8	44 40.6	45 39.0	44 39.7
25	46 11.3	47 28.5	46 10.6	47 27.4	46 09.8	47 26.3	46 09.1	47 25.2
10 30	+46 36.5	- 50 24.6	+46 35.8	- 50 23.3	+46 35.1	- 50 22.0	+46 34.3	- 50 20.6
35	46 56.2	53 31.7	46 55.5	53 30.1	46 54.8	53 28.6	46 54.1	53 27.0
40	47 09.8	56 51.0	47 09.1	56 49.1	47 08.4	56 47.3	47 07.7	56 45.5
45	47 16.2	60 24.0	47 15.6	60 21.9	47 15.0	60 19.7	47 14.3	60 17.6
50	47 14.4	64 12.8	47 13.9	64 10.3	47 13.3	64 07.8	47 12.8	64 05.4
55	47 02.9	68 20.1	47 02.4	68 17.2	47 02.0	68 14.4	47 01.5	68 11.6
11 00	+46 39.5	- 72 50.2	+46 39.1	- 72 46.9	+46 38.8	- 72 43.6	+46 38.5	- 72 40.3
05	46 00.9	77 49.9	46 00.7	77 46.0	46 00.6	77 42.2	46 00.4	77 38.3
10	45 01.4	83 31.9	45 01.5	83 27.2	45 01.7	83 22.6	45 01.8	83 18.0
11 12	+44 29.5	- 86 05.8	+44 29.8	- 86 00.7	+44 30.1	- 85 55.7	+44 30.4	- 85 50.7
14	43 51.3	88 53.7	43 51.8	88 48.1	43 52.3	88 42.5	43 52.8	88 37.0
16	43 04.6	92 00.8	43 05.4	91 54.5	43 06.2	91 48.2	43 07.0	91 42.0
18	42 05.6	95 37.0	42 06.8	95 29.5	42 08.1	95 22.1	42 09.3	95 14.8
11 20	+40 45.4	-100 04.7	+40 47.5	- 99 55.1	+40 49.6	- 99 45.6	+40 51.6	- 99 36.1
21	39 50.0	102 57.1	39 53.0	102 45.2	39 55.9	102 33.5	39 58.8	102 21.9
22	+38 29.2	-106 55.0	+38 34.5	-106 37.0	+38 39.6	-106 19.6	+38 44.5	-106 02.8

DURATION OF ANNULAR PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time	10,000 Feet Duration	10,000 Feet Width of Path	20,000 Feet Duration	20,000 Feet Width of Path	30,000 Feet Duration	30,000 Feet Width of Path	40,000 Feet Duration	40,000 Feet Width of Path
h m	m s	mi	m s	mi	m s	mi	m s	mi
7 54	. .. .	...	0 55.3	40	0 54.8	39	0 54.4	39
55	0 51.4	36	0 51.3	36	0 51.1	36	0 51.0	36
56	0 49.2	34	0 49.1	33	0 49.0	33	0 48.9	33
57	0 47.5	32	0 47.4	32	0 47.3	32	0 47.2	32
58	0 46.0	31	0 45.9	31	0 45.8	31	0 45.7	31
8 00	0 43.4	29	0 43.3	29	0 43.3	29	0 43.2	29
02	0 41.1	26	0 41.1	26	0 41.0	26	0 41.0	26
04	0 39.1	25	0 39.0	25	0 39.0	25	0 38.9	25
06	0 37.2	23	0 37.2	23	0 37.1	23	0 37.1	23
08	0 35.5	21	0 35.4	21	0 35.4	21	0 35.3	21
8 10	0 33.8	21	0 33.8	21	0 33.7	21	0 33.7	21
15	0 30.0	17	0 30.0	17	0 29.9	17	0 29.9	17
20	0 26.6	15	0 26.5	15	0 26.5	15	0 26.4	15
25	0 23.5	13	0 23.4	13	0 23.4	13	0 23.3	13
8 30	0 20.6	11	0 20.5	11	0 20.5	11	0 20.4	11
35	0 17.9	10	0 17.9	10	0 17.8	10	0 17.8	10
40	0 15.5	8	0 15.4	8	0 15.4	8	0 15.3	8
45	0 13.2	6	0 13.2	6	0 13.1	6	0 13.1	6
50	0 11.1	6	0 11.1	6	0 11.0	6	0 11.0	6
55	0 09.2	4	0 09.2	4	0 09.1	4	0 09.1	4
9 00	0 07.5	3	0 07.5	3	0 07.4	3	0 07.4	3
05	0 06.0	2	0 05.9	2	0 05.9	2	0 05.8	2
10	0 04.6	2	0 04.6	2	0 04.5	2	0 04.5	2
15	0 03.5	2	0 03.4	2	0 03.4	2	0 03.3	2
20	0 02.5	1	0 02.4	1	0 02.4	1	0 02.3	1
25	0 01.7	1	0 01.6	1	0 01.6	1	0 01.5	1
9 30	0 01.1	1	0 01.0	1	0 01.0	1	0 00.9	0
35	0 00.6	0	0 00.6	0	0 00.5	0	0 00.5	0
40	0 00.4	0	0 00.4	0	0 00.3	0	0 00.3	0
45	0 00.4	0	0 00.3	0	0 00.3	0	0 00.2	0
50	0 00.5	0	0 00.5	0	0 00.4	0	0 00.4	0
55	0 00.9	0	0 00.8	0	0 00.8	0	0 00.7	0
10 00	0 01.4	1	0 01.4	1	0 01.3	1	0 01.3	1
05	0 02.2	1	0 02.2	1	0 02.1	1	0 02.1	1
10	0 03.2	2	0 03.1	2	0 03.1	2	0 03.0	2
15	0 04.3	2	0 04.3	2	0 04.3	2	0 04.2	2
20	0 05.7	2	0 05.6	2	0 05.6	2	0 05.6	2
25	0 07.3	3	0 07.2	3	0 07.2	3	0 07.1	3
10 30	0 09.0	4	0 09.0	4	0 08.9	4	0 08.9	4
35	0 11.0	5	0 11.0	5	0 10.9	5	0 10.9	5
40	0 13.2	6	0 13.2	6	0 13.1	6	0 13.1	6
45	0 15.6	7	0 15.6	7	0 15.5	7	0 15.5	7
50	0 18.3	9	0 18.2	9	0 18.2	9	0 18.1	9
55	0 21.1	10	0 21.1	10	0 21.0	10	0 21.0	10
11 00	0 24.3	13	0 24.3	13	0 24.2	13	0 24.2	13
05	0 27.8	15	0 27.8	15	0 27.7	15	0 27.7	15
10	0 31.8	18	0 31.8	18	0 31.7	18	0 31.7	18
11 12	0 33.6	20	0 33.6	19	0 33.5	19	0 33.4	19
14	0 35.5	21	0 35.5	21	0 35.4	21	0 35.3	21
16	0 37.6	23	0 37.6	23	0 37.5	23	0 37.4	23
18	0 40.0	25	0 40.0	25	0 39.9	25	0 39.8	25
11 20	0 42.9	28	0 42.8	28	0 42.7	28	0 42.6	28
21	0 44.7	30	0 44.6	29	0 44.5	29	0 44.4	29
22	0 47.1	33	0 47.0	33	0 46.8	32	0 46.6	32

CENTRAL LINE OF ANNULAR ECLIPSE

Universal Time	100 Km		200 Km		300 Km	
h m	Latitude ° ′	Longitude ° ′	Latitude ° ′	Longitude ° ′	Latitude ° ′	Longitude ° ′
7 49	.. .. .	... .. .	.. .. .	... .. .	+ 2 47.6	+ 23 41.5
50	.. .. .	... .. .	.. .. .	... .. .	4 13.9	20 25.5
51	.. .. .	... .. .	+ 3 22.1	+ 23 35.2	5 15.6	18 15.7
52	.. .. .	... .. .	4 43.0	20 33.9	6 07.2	16 33.2
7 54	+ 5 12.2	+ 20 43.9	+ 6 34.2	+ 16 48.2	+ 7 34.4	+ 13 50.9
56	7 01.6	17 03.7	8 00.9	14 07.6	8 49.1	11 41.1
58	8 28.0	14 24.8	9 15.6	11 58.5	9 56.0	9 51.2
8 00	+ 9 42.6	+ 12 16.2	+10 22.7	+ 10 08.7	+10 57.6	+ 8 14.8
05	12 21.3	8 05.3	12 49.7	6 25.4	13 15.3	4 53.2
10	14 36.9	4 50.4	14 58.2	3 26.4	15 17.5	+ 2 07.5
15	16 38.5	+ 2 07.5	16 54.6	+ 0 54.2	17 09.3	- 0 15.2
20	18 30.3	- 0 14.6	18 42.3	- 1 19.9	18 53.3	2 22.1
25	20 14.8	2 22.2	20 23.3	3 21.2	20 31.2	4 17.5
8 30	+21 53.3	- 4 19.3	+21 58.9	- 5 13.0	+22 04.1	- 6 04.5
35	23 26.9	6 08.7	23 30.0	6 57.9	23 32.7	7 45.1
40	24 56.4	7 52.2	24 57.2	8 37.5	24 57.6	9 21.0
45	26 22.3	9 31.5	26 20.9	10 13.2	26 19.3	10 53.2
50	27 44.9	11 07.7	27 41.5	11 46.1	27 38.1	12 23.0
55	29 04.6	12 41.9	28 59.3	13 17.1	28 54.1	13 51.0
9 00	+30 21.5	- 14 14.8	+30 14.5	- 14 47.0	+30 07.7	- 15 18.1
05	31 35.9	15 47.3	31 27.3	16 16.6	31 18.9	16 44.8
10	32 47.9	17 19.9	32 37.7	17 46.3	32 27.8	18 11.7
15	33 57.5	18 53.2	33 45.8	19 16.8	33 34.5	19 39.4
20	35 04.8	20 27.9	34 51.8	20 48.5	34 39.1	21 08.4
25	36 09.9	22 04.4	35 55.5	22 22.1	35 41.5	22 39.1
9 30	+37 12.7	- 23 43.3	+36 57.1	- 23 57.9	+36 41.9	- 24 11.9
35	38 13.3	25 25.0	37 56.4	25 36.4	37 40.1	25 47.4
40	39 11.5	27 10.1	38 53.5	27 18.2	38 36.1	27 25.9
45	40 07.2	28 59.0	39 48.2	29 03.6	39 29.8	29 08.0
50	41 00.5	30 52.3	40 40.6	30 53.2	40 21.2	30 54.0
55	41 51.2	32 50.5	41 30.3	32 47.4	41 10.2	32 44.5
10 00	+42 39.0	- 34 54.1	+42 17.4	- 34 46.8	+41 56.5	- 34 39.9
05	43 23.9	37 03.7	43 01.6	36 51.9	42 40.1	36 40.7
10	44 05.5	39 19.9	43 42.7	39 03.2	43 20.7	38 47.3
15	44 43.6	41 43.2	44 20.5	41 21.3	43 58.1	41 00.5
20	45 18.0	44 14.4	44 54.7	43 46.9	44 32.1	43 20.7
25	45 48.1	46 54.3	45 24.8	46 20.6	45 02.3	45 48.6
10 30	+46 13.6	- 49 43.5	+45 50.6	- 49 03.2	+45 28.3	- 48 25.0
35	46 34.0	52 43.1	46 11.5	51 55.6	45 49.7	51 10.5
40	46 48.5	55 54.2	46 27.0	54 58.8	46 05.9	54 06.2
45	46 56.4	59 18.2	46 36.2	58 14.0	46 16.3	57 13.3
50	46 56.7	62 56.8	46 38.4	61 42.9	46 20.2	60 33.0
55	46 48.0	66 52.5	46 32.2	65 27.5	46 16.3	64 07.5
11 00	+46 28.4	- 71 09.0	+46 16.2	- 69 31.1	+46 03.3	- 67 59.2
05	45 55.3	75 51.7	45 47.9	73 58.2	45 39.4	72 12.2
10	45 04.0	81 10.8	45 03.8	78 56.9	45 01.3	76 53.0
15	43 34.4	90 47.6	43 28.6	90 30.3	43 22.7	90 13.4
11 20	+41 38.1	- 95 35.8	+42 13.2	- 91 50.7	+42 37.1	- 88 37.6
22	40 15.6	100 07.6	41 12.4	95 27.4	41 48.8	91 42.5
24	+37 47.2	-107 28.0	39 48.2	100 01.7	40 47.1	95 19.4
11 25	.. .. .	... .. .	+38 47.7	-103 05.6	+40 08.4	- 97 27.2
26	.. .. .	... .. .	+37 08.2	-107 51.1	39 21.1	99 56.8
27	.. .. .	... .. .	.. .. .	... .. .	38 17.9	103 06.8
28	.. .. .	... .. .	.. .. .	... .. .	+36 23.5	-108 30.9

DURATION OF ANNULAR PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time h m	100 Km Duration m s	100 Km Width of Path mi	200 Km Duration m s	200 Km Width of Path mi	300 Km Duration m s	300 Km Width of Path mi
7 49	. .. .	...	. .. .	...	0 52.8	37
50	. .. .	...	. .. .	...	0 50.1	34
51	. .. .	...	0 52.3	37	0 48.1	32
52	. .. .	...	0 49.8	34	0 46.5	31
7 54	0 49.6	34	0 46.3	31	0 43.7	28
56	0 46.2	31	0 43.6	29	0 41.3	27
58	0 43.5	28	0 41.2	26	0 39.1	25
8 00	0 41.2	27	0 39.1	25	0 37.1	23
05	0 36.3	23	0 34.5	21	0 32.6	20
10	0 32.1	19	0 30.4	18	0 28.7	17
15	0 28.4	16	0 26.8	16	0 25.1	14
20	0 25.0	14	0 23.5	13	0 21.9	12
25	0 22.0	12	0 20.4	11	0 18.8	10
8 30	0 19.1	10	0 17.6	9	0 16.0	8
35	0 16.4	8	0 14.9	7	0 13.4	7
40	0 14.0	7	0 12.5	7	0 11.0	5
45	0 11.7	6	0 10.2	5	0 08.7	4
50	0 09.7	5	0 08.2	4	0 06.6	3
55	0 07.8	4	0 06.3	3	0 04.7	2
9 00	0 06.1	2	0 04.5	2	0 03.0	2
05	0 04.5	2	0 03.0	2	0 01.4	1
10	0 03.2	2	0 01.6	1	0 00.1	0
15	0 02.0	1	0 00.5	0	0 01.1	1
20	0 01.0	1	0 00.6	0	0 02.2	1
25	0 00.2	0	0 01.4	1	0 03.0	1
9 30	0 00.4	0	0 02.0	1	0 03.6	2
35	0 00.9	0	0 02.4	1	0 04.0	2
40	0 01.1	1	0 02.7	1	0 04.3	2
45	0 01.1	1	0 02.7	1	0 04.3	2
50	0 01.0	0	0 02.6	1	0 04.2	2
55	0 00.6	0	0 02.2	1	0 03.8	2
10 00	0 00.1	0	0 01.7	1	0 03.3	2
05	0 00.7	0	0 00.9	0	0 02.5	1
10	0 01.7	1	0 00.1	0	0 01.6	1
15	0 02.8	1	0 01.2	1	0 00.4	0
20	0 04.2	2	0 02.6	1	0 00.9	0
25	0 05.7	2	0 04.1	2	0 02.5	1
10 30	0 07.5	3	0 05.9	2	0 04.3	2
35	0 09.5	4	0 07.9	3	0 06.2	2
40	0 11.7	6	0 10.1	5	0 08.4	3
45	0 14.1	6	0 12.4	6	0 10.8	5
50	0 16.7	8	0 15.1	7	0 13.4	6
55	0 19.5	10	0 17.9	9	0 16.2	7
11 00	0 22.7	11	0 21.0	11	0 19.3	9
05	0 26.1	14	0 24.4	13	0 22.6	12
10	0 30.0	17	0 28.2	16	0 26.3	14
15	0 34.5	20	0 32.4	19	0 30.5	17
11 20	0 40.1	25	0 37.6	23	0 35.3	21
22	0 43.1	28	0 40.1	25	0 37.5	23
24	0 47.7	33	0 43.2	29	0 40.1	25
11 25	. .. .	...	0 45.2	30	0 41.6	27
26	. .. .	...	0 48.2	34	0 43.3	28
27	. .. .	...	. .. .	...	0 45.4	31
28	. .. .	...	. .. .	...	0 48.8	34

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

Universal Time	Central Line Latitude	Central Line Longitude	First Contact Universal Time	First Contact P	First Contact V	Second Contact Universal Time	Second Contact P	Second Contact V
h m	° ′	° ′	h m s	°	°	h m s	°	°
7 55	+ 4 28.0	+ 23 36.1	.. ..	...	...	7 54 34.2	242	330
56	5 41.7	20 55.1	.. ..	...	...	7 55 35.3	241	329
57	6 39.6	18 56.7	.. ..	...	...	7 56 36.2	241	328
58	7 29.6	17 19.7	6 57 59.0	242	324	7 57 37.0	241	328
8 00	+ 8 55.6	+ 14 42.2	6 58 40.6	242	323	7 59 38.3	240	327
02	10 10.3	12 34.1	6 59 32.4	241	323	8 01 39.4	240	326
04	11 17.8	10 44.3	7 00 30.7	241	322	8 03 40.4	239	325
06	12 20.1	9 07.5	7 01 33.8	240	321	8 05 41.3	239	324
08	13 18.4	7 40.3	7 02 40.3	240	320	8 07 42.2	238	324
8 10	+14 13.6	+ 6 20.5	7 03 49.7	240	320	8 09 43.1	238	323
15	16 21.0	3 25.2	7 06 52.6	239	318	8 14 44.9	238	321
20	18 17.3	+ 0 54.2	7 10 05.5	239	316	8 19 46.7	237	319
25	20 05.4	- 1 20.4	7 13 25.7	238	315	8 24 48.2	237	317
8 30	+21 47.1	- 3 23.2	7 16 52.0	238	313	8 29 49.7	237	315
35	23 23.5	5 17.3	7 20 23.4	238	312	8 34 51.0	236	313
40	24 55.4	7 05.1	7 23 59.2	238	310	8 39 52.3	236	311
45	26 23.5	8 48.2	7 27 39.0	237	309	8 44 53.4	236	309
50	27 48.2	10 27.9	7 31 22.7	237	307	8 49 54.4	236	306
55	29 09.8	12 05.3	7 35 10.0	237	306	8 54 55.4	236	303
9 00	+30 28.6	- 13 41.4	7 39 00.8	237	304	8 59 56.2	237	300
05	31 44.7	15 16.9	7 42 55.4	237	302	9 04 57.0	237	296
10	32 58.3	16 52.5	7 46 53.5	238	300	9 09 57.7	237	292
15	34 09.5	18 28.8	7 50 55.4	238	298	9 14 58.3	238	287
20	35 18.3	20 06.5	7 55 01.1	238	296	9 19 58.7	238	282
25	36 24.7	21 46.1	7 59 11.0	238	294	9 24 59.2	239	276
9 30	+37 28.9	- 23 28.1	8 03 25.3	239	291	9 29 59.5	239	270
35	38 30.7	25 13.1	8 07 44.2	239	288	9 34 59.6	239	262
40	39 30.0	27 01.7	8 12 07.9	239	285	9 39 59.8	239	255
45	40 26.9	28 54.2	8 16 36.8	240	282	9 44 59.8	241	250
50	41 21.2	30 51.4	8 21 11.5	240	278	9 49 59.7	242	243
55	42 12.7	32 53.7	8 25 52.2	241	273	9 54 59.5	243	238
10 00	+43 01.3	- 35 01.7	8 30 39.5	242	269	9 59 59.3	243	232
05	43 46.8	37 16.0	8 35 33.8	242	264	10 04 58.9	244	228
10	44 29.0	39 37.3	8 40 35.8	243	258	10 09 58.4	245	224
15	45 07.5	42 06.2	8 45 46.0	244	253	10 14 57.8	246	221
20	45 42.0	44 43.3	8 51 05.0	244	247	10 19 57.1	247	218
25	46 12.1	47 29.6	8 56 33.6	245	241	10 24 56.3	248	215
10 30	+46 37.3	- 50 25.9	9 02 12.4	246	236	10 29 55.4	248	213
35	46 57.0	53 33.3	9 08 02.4	247	231	10 34 54.5	249	212
40	47 10.4	56 52.8	9 14 04.1	248	226	10 39 53.3	250	211
45	47 16.8	60 26.1	9 20 19.0	249	222	10 44 52.1	252	210
50	47 15.0	64 15.2	9 26 47.7	250	218	10 49 50.8	252	209
55	47 03.4	68 22.9	9 33 32.0	252	215	10 54 49.4	253	208
11 00	+46 39.8	- 72 53.4	9 40 33.8	253	212	10 59 47.8	254	208
05	46 01.0	77 53.7	9 47 56.0	254	209	11 04 46.0	256	208
10	45 01.3	83 36.5	9 55 44.3	255	208	11 09 44.0	257	208
11 12	+44 29.2	- 86 10.8	9 59 01.1	256	207	11 11 43.1	257	208
14	43 50.8	88 59.3	10 02 25.2	256	206	11 13 42.2	257	208
16	43 03.8	92 07.2	10 05 58.7	257	206	11 15 41.2	258	208
18	42 04.3	95 44.5	10 09 46.0	258	205	11 17 40.0	258	208
11 20	+40 43.3	-100 14.4	10 13 56.7	258	205	11 19 38.5	259	208
21	39 47.0	103 09.1	10 16 19.3	259	205	11 20 37.6	259	208
22	+38 23.6	-107 13.8	10 19 11.5	259	204	11 21 36.4	260	208

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

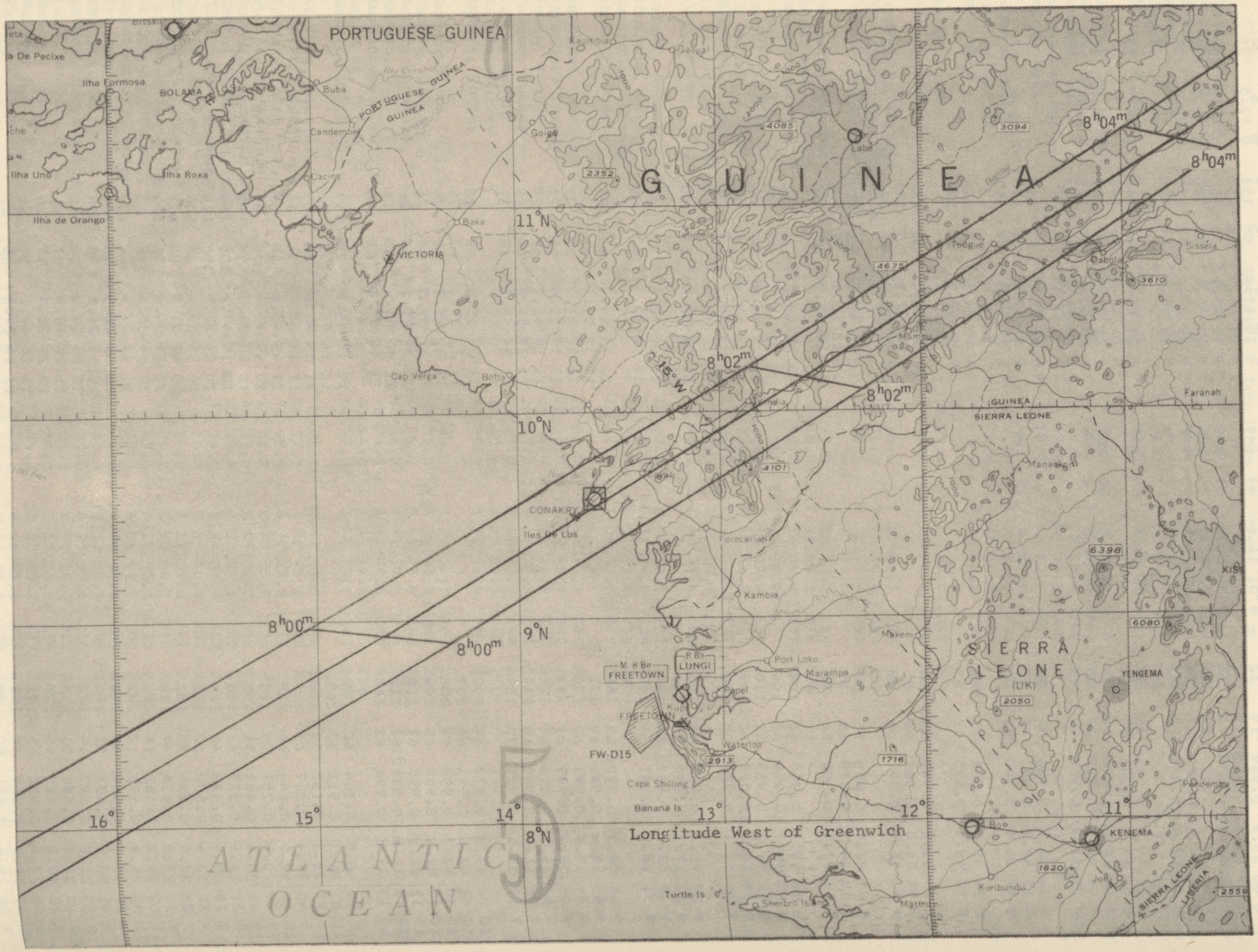
Maximum Eclipse				Third Contact			Fourth Contact			Dura-tion	Width of Path
Universal Time	Magni-tude	Sun's Alt.	Sun's Az.	Universal Time	P	V	Universal Time	P	V		
h m s		°	°	h m s	°	°	h m s	°	°	m s	*mi*
7 55 00.0	0.986	7	70	7 55 25.8	62	150	8 58 45.0	60	154	0 51.6	36
7 56 00.0	0.987	10	71	7 56 24.7	61	149	9 01 17.5	60	153	0 49.4	34
7 57 00.0	0.987	13	71	7 57 23.8	61	148	9 03 29.8	59	152	0 47.6	32
7 58 00.0	0.988	15	71	7 58 23.0	61	148	9 05 31.9	59	152	0 46.0	31
8 00 00.0	0.989	18	72	8 00 21.7	60	147	9 09 18.4	58	151	0 43.4	29
8 02 00.0	0.990	21	72	8 02 20.6	60	146	9 12 50.5	58	150	0 41.2	26
8 04 00.0	0.990	24	73	8 04 19.6	59	145	9 16 13.1	57	149	0 39.2	25
8 06 00.0	0.991	26	74	8 06 18.7	59	144	9 19 29.0	57	149	0 37.4	23
8 08 00.0	0.992	28	74	8 08 17.8	58	144	9 22 39.4	57	148	0 35.6	21
8 10 00.0	0.992	30	75	8 10 16.9	58	143	9 25 45.7	57	147	0 33.8	21
8 15 00.0	0.993	34	77	8 15 15.1	58	141	9 33 16.3	56	145	0 30.2	17
8 20 00.0	0.994	38	79	8 20 13.3	57	139	9 40 30.2	56	143	0 26.6	15
8 25 00.0	0.995	42	81	8 25 11.8	57	137	9 47 30.4	56	140	0 23.6	13
8 30 00.0	0.996	45	83	8 30 10.3	57	135	9 54 18.7	56	137	0 20.6	11
8 35 00.0	0.996	48	86	8 35 09.0	56	133	10 00 56.4	56	133	0 18.0	10
8 40 00.0	0.997	51	89	8 40 07.7	56	131	10 07 23.9	56	127	0 15.4	8
8 45 00.0	0.997	54	92	8 45 06.6	56	129	10 13 41.7	56	121	0 13.2	6
8 50 00.0	0.998	56	95	8 50 05.6	57	126	10 19 50.2	56	112	0 11.2	6
8 55 00.0	0.998	58	99	8 55 04.6	57	123	10 25 49.4	57	101	0 09.2	5
9 00 00.0	0.999	61	104	9 00 03.8	57	120	10 31 39.4	57	89	0 07.6	3
9 05 00.0	0.999	63	109	9 05 03.0	57	116	10 37 20.2	58	76	0 06.0	2
9 10 00.0	0.999	64	114	9 10 02.3	57	112	10 42 52.0	58	64	0 04.6	2
9 15 00.0	0.999	66	121	9 15 01.7	58	108	10 48 15.0	59	54	0 03.4	2
9 20 00.0	1.000	67	128	9 20 01.3	58	101	10 53 29.1	59	46	0 02.6	1
9 25 00.0	1.000	68	135	9 25 00.8	59	96	10 58 34.4	60	40	0 01.6	1
9 30 00.0	1.000	69	143	9 30 00.5	59	90	11 03 31.3	61	36	0 01.0	1
9 35 00.0	1.000	69	152	9 35 00.4	61	84	11 08 19.6	62	32	0 00.8	0
9 40 00.0	1.000	69	161	9 40 00.2	61	79	11 12 59.7	62	30	0 00.4	0
9 45 00.0	1.000	69	170	9 45 00.2	62	70	11 17 31.9	63	28	0 00.4	0
9 50 00.0	1.000	69	178	9 50 00.3	62	63	11 21 56.2	64	27	0 00.6	0
9 55 00.0	1.000	68	186	9 55 00.5	63	56	11 26 13.0	65	26	0 01.0	0
10 00 00.0	1.000	66	194	10 00 00.7	63	52	11 30 22.5	66	26	0 01.4	1
10 05 00.0	1.000	65	201	10 05 01.1	64	48	11 34 25.0	67	26	0 02.2	1
10 10 00.0	0.999	63	208	10 10 01.6	65	44	11 38 20.7	67	25	0 03.2	2
10 15 00.0	0.999	61	214	10 15 02.2	66	40	11 42 09.8	68	25	0 04.4	2
10 20 00.0	0.999	59	220	10 20 02.9	67	38	11 45 52.5	69	25	0 05.8	2
10 25 00.0	0.999	57	226	10 25 03.7	68	35	11 49 29.0	70	26	0 07.4	3
10 30 00.0	0.998	54	231	10 30 04.6	69	34	11 52 59.3	71	26	0 09.2	4
10 35 00.0	0.998	52	236	10 35 05.5	69	32	11 56 23.6	72	26	0 11.0	5
10 40 00.0	0.997	49	241	10 40 06.7	70	31	11 59 41.8	73	27	0 13.4	6
10 45 00.0	0.997	46	246	10 45 07.9	72	30	12 02 53.8	73	27	0 15.8	7
10 50 00.0	0.996	43	251	10 50 09.2	73	29	12 05 59.0	74	28	0 18.4	9
10 55 00.0	0.995	39	256	10 55 10.6	74	29	12 08 56.8	75	28	0 21.2	10
11 00 00.0	0.995	36	261	11 00 12.2	75	28	12 11 46.0	76	29	0 24.4	13
11 05 00.0	0.994	31	267	11 05 14.0	76	28	12 14 24.6	77	30	0 28.0	15
11 10 00.0	0.992	26	272	11 10 16.0	77	28	12 16 48.2	78	30	0 32.0	18
11 12 00.0	0.992	24	275	11 12 16.9	77	28	12 17 39.8	78	31	0 33.8	20
11 14 00.0	0.991	22	277	11 14 17.8	78	28	12 18 26.6	78	31	0 35.6	21
11 16 00.0	0.991	19	280	11 16 18.8	78	28	12 19 06.8	79	31	0 37.6	23
11 18 00.0	0.990	16	283	11 18 20.0	78	28	12 19 37.3	79	32	0 40.0	25
11 20 00.0	0.989	12	286	11 20 21.5	79	28	12 19 50.4	79	33	0 43.0	28
11 21 00.0	0.988	9	288	11 21 22.4	79	28	.. ..	...	...	0 44.8	30
11 22 00.0	0.987	6	291	11 22 23.6	80	28	.. ..	...	...	0 47.2	32

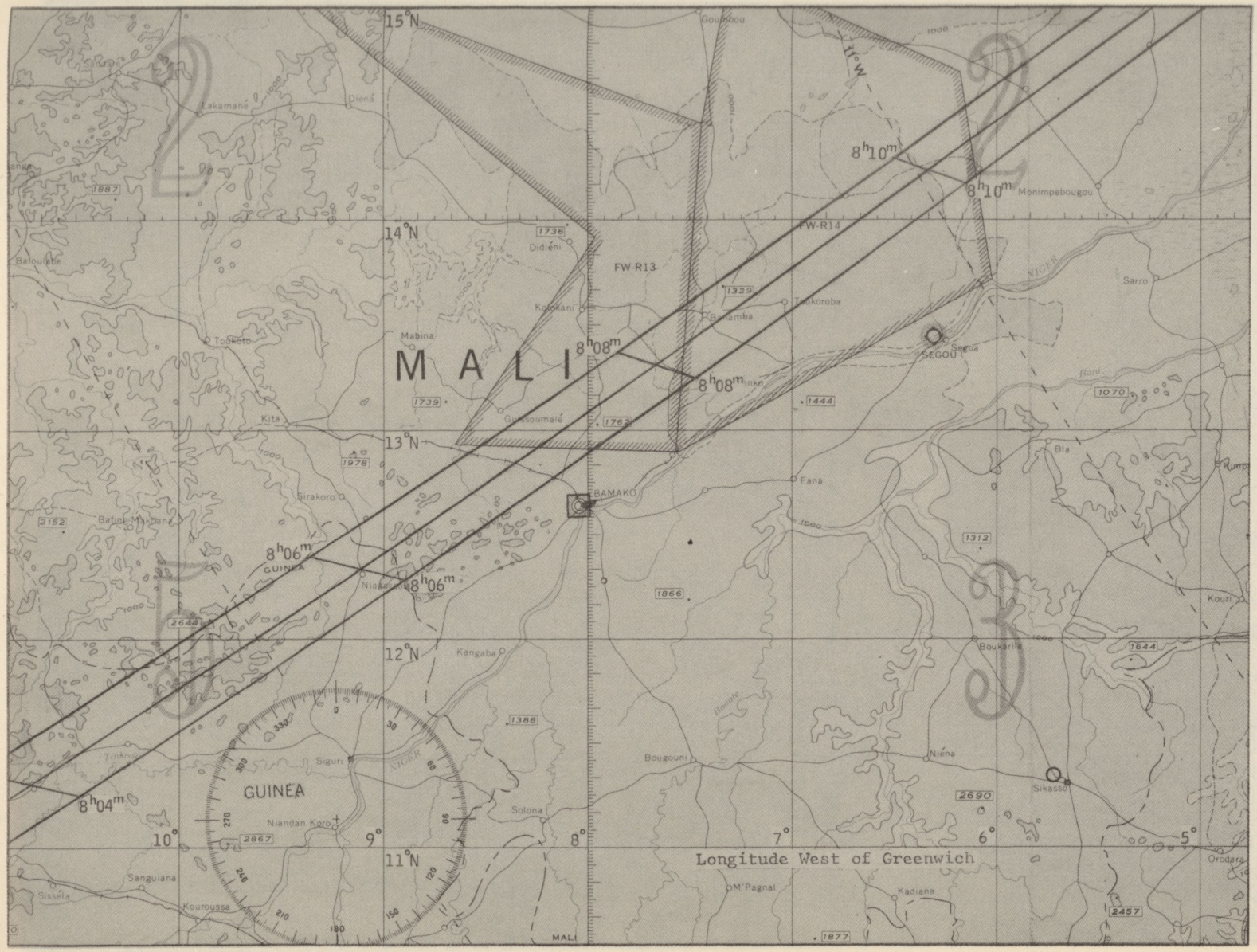
LOCAL CIRCUMSTANCES

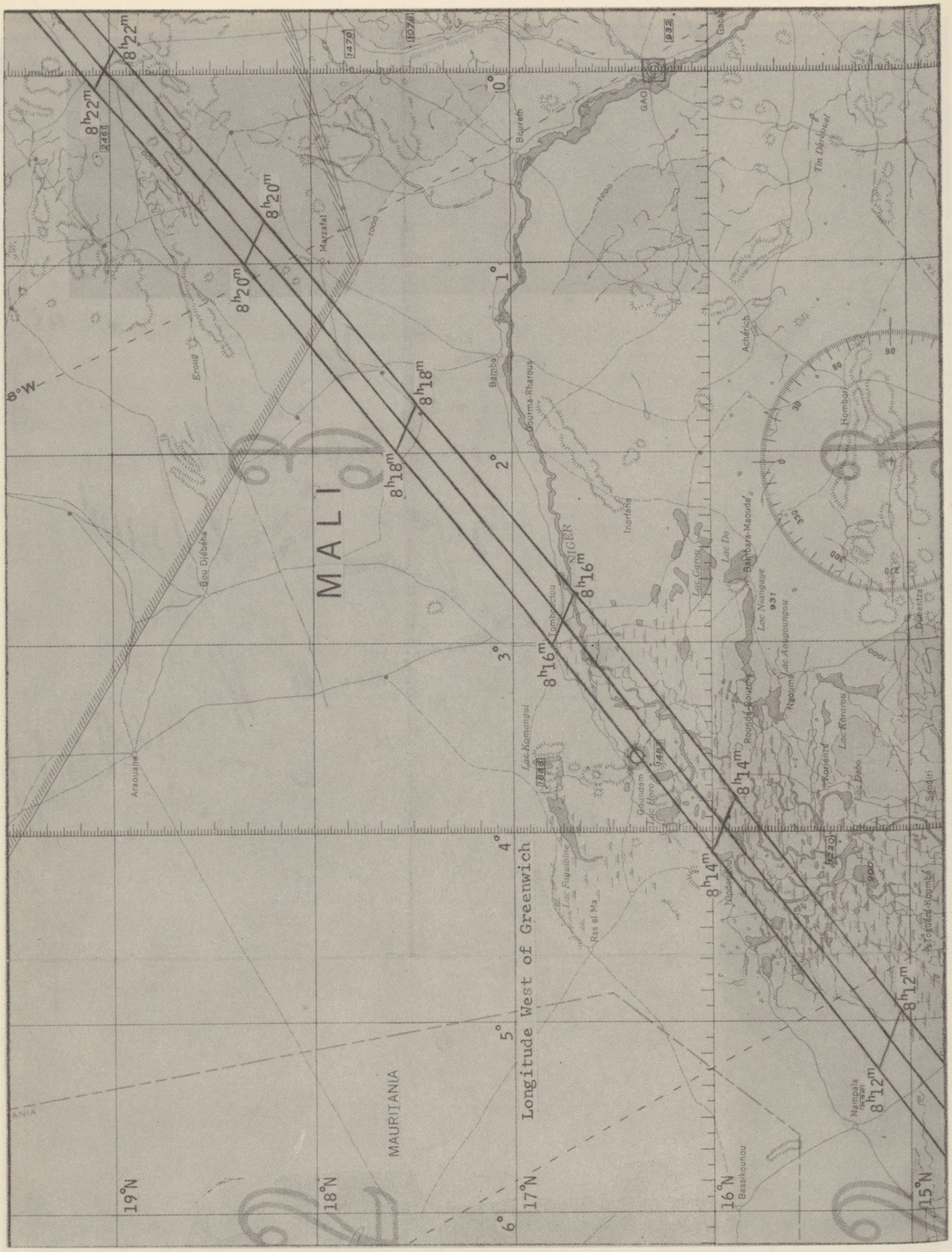
Geographic Locations	Latitude	Longitude	First Contact Universal Time	P	V	Second Contact Universal Time	P	V
	° ′	° ′	h m s	°	°	h m s	°	°
Conakry, Guinea	+ 9 30.0	+ 13 43.0	6 59 02.8	241	323	8 00 32.1	238	325
Freetown, Sierra Leone	+ 8 30.0	+ 13 14.0	6 57 52.7	243	326			
Kindia, Guinea	+10 03.0	+ 12 51.0	6 59 27.7	241	323	8 01 26.3	228	314
Mamou, Guinea	+10 23.0	+ 12 04.0	6 59 40.8	241	323	8 02 05.5	264	350
Tougue, Guinea	+10 48.0	+ 11 38.0	7 00 04.7	241	322	8 02 44.8	223	310
Dabola, Guinea	+10 44.0	+ 11 06.0	6 59 54.7	241	323			
Niagassola, Guinea	+12 19.0	+ 9 06.0	7 01 32.3	240	321	8 05 40.7	248	334
Bamako, Mali	+12 38.0	+ 7 59.0	7 01 50.3	241	321			
Banamba, Mali	+13 33.0	+ 7 25.0	7 02 58.4	240	320	8 08 12.0	217	302
Toukoroba, Mali	+13 36.0	+ 7 02.0	7 03 01.3	240	320	8 08 32.1	288	13
Segou, Mali	+13 28.0	+ 6 18.0	7 02 50.0	241	321			
Goundam, Mali	+16 25.0	+ 3 41.0	7 06 57.0	239	317			
Tombouctou, Mali	+16 47.0	+ 3 01.0	7 07 32.3	239	317	8 15 49.8	182	265
Gao, Mali	+16 17.0	+ 0 04.0	7 07 19.1	242	322			
Tessalit, Mali	+20 15.0	- 0 59.0	7 13 35.7	238	314			
Silet, Algeria	+22 39.0	- 4 34.0	7 18 47.7	238	313			
In Amguel, Algeria	+23 49.0	- 5 10.0	7 21 05.3	237	311			
Fort Laperrine, Algeria	+22 47.0	- 5 31.0	7 19 26.0	239	313			
Fort de Polignac, Algeria	+26 32.0	- 8 32.0	7 27 45.4	237	308			
Tan Kena, Algeria	+26 34.0	- 9 37.0	7 28 28.7	238	309			
In Amenas, Algeria	+28 03.0	- 9 38.0	7 31 18.8	236	306			
Edjeleh, Libya	+27 49.0	- 9 58.0	7 31 04.4	237	307			
Tripoli, Libya	+32 53.0	- 13 12.0	7 43 32.4	234	298			
Al Qaryah, Libya	+30 23.0	- 13 33.0	7 38 42.8	237	304	8 59 32.9	202	266
Misratah, Libya	+32 22.0	- 15 06.0	7 44 01.4	237	300			
Al Qaddahiyah, Libya	+31 36.0	- 15 08.0	7 42 29.9	237	302			
Al Bu'ayrat, Libya	+31 23.0	- 15 43.0	7 42 35.6	238	303			
Kalami, Greece	+37 02.0	- 22 07.0	8 00 52.0	238	292			
Stefania, Greece	+36 51.0	- 22 36.0	8 01 04.3	238	293			
Korinthos, Greece	+37 56.0	- 22 58.0	8 03 43.4	238	290			
Athinai, Greece	+37 58.3	- 23 43.0	8 04 43.4	238	290			
Bandirma, Turkey	+40 22.0	- 28 00.0	8 15 10.1	239	282			
Istanbul, Turkey	+41 00.8	- 28 58.0	8 17 46.7	239	280			
Bursa, Turkey	+40 12.0	- 29 04.0	8 16 22.9	240	282			
Yalova, Turkey	+40 39.0	- 29 17.0	8 17 32.8	240	281			
Izmit, Turkey	+40 47.0	- 29 55.0	8 18 43.7	240	280			
Bartin, Turkey	+41 37.0	- 32 20.0	8 23 56.3	241	276			
Ankara, Turkey	+39 55.0	- 32 50.0	8 21 47.5	244	281			
Novorossiysk, U.S.S.R.	+44 44.0	- 37 46.0	8 37 52.1	241	260			
Tuapse, U.S.S.R.	+44 06.0	- 39 05.0	8 39 07.1	243	260			
Belorechenskaya, U.S.S.R.	+44 46.0	- 39 54.0	8 41 28.6	243	257			
Maykop, U.S.S.R.	+44 37.0	- 40 08.0	8 41 39.8	243	257	10 11 01.6	283	261
Kurgannaya, U.S.S.R.	+44 54.0	- 40 34.0	8 42 48.2	243	256			
Labinska, U.S.S.R.	+44 39.0	- 40 44.0	8 42 44.8	243	256			
Amavir, U.S.S.R.	+45 00.0	- 41 07.0	8 43 53.3	243	255			
Algiers, Algeria	+36 48.1	- 3 02.1	7 47 13.7	222	281			
Alma-Ata, Kazak S.S.R.	+43 11.3	- 76 57.5	9 48 48.4	259	211			
Bombay, India	+18 53.6	- 72 48.9	10 31 25.0	313	231			
Bucharest, Romania	+44 24.8	- 26 05.8	8 20 53.0	233	270			
Burakan, Armenian S.S.R.	+40 20.1	- 44 17.5	8 44 32.2	252	260			
Castel Gandolfo, Italy	+41 44.8	- 12 39.1	8 02 57.1	225	275			
Copenhagen, Denmark	+55 41.2	- 12 34.7	8 37 02.9	212	241			
Dublin, Ireland	+53 23.2	+ 6 20.3	8 28 40.1	201	239			
Edinburgh, Scotland	+55 55.5	+ 3 11.0	8 35 07.4	201	235			
Geneva, Switzerland	+46 12.0	- 6 09.2	8 10 54.1	216	262			
Heidelberg, Germany	+49 23.9	- 8 43.3	8 19 46.1	215	255			
Herstmonceux, Sussex	+50 52.3	- 0 20.3	8 21 47.3	208	248			
Irkutsk, R.S.F.S.R.	+52 16.5	-104 16.8	10 06 06.8	239	198			
Kunming, China	+25 01.5	-102 47.3	10 33 55.1	284	215			
Leiden, Netherlands	+52 09.3	- 4 29.0	8 25 39.6	210	247			
Lund, Sweden	+55 41.9	- 13 11.2	8 37 19.2	212	241			
Madrid, Spain	+40 24.5	+ 3 41.3	7 55 03.2	214	268			
Moscow, R.S.F.S.R.	+55 45.3	- 37 34.2	8 55 43.7	227	234			
Paris, France	+48 50.2	- 2 20.2	8 16 43.1	211	254			
Simeis, Crimea, R.S.F.S.R.	+44 24.2	- 33 59.8	8 31 24.4	239	266			
Tashkent, Uzbek S.S.R.	+41 19.5	- 69 17.6	9 37 51.0	262	215			
Uccle, Belgium	+50 47.9	- 4 21.5	8 22 07.7	211	250			

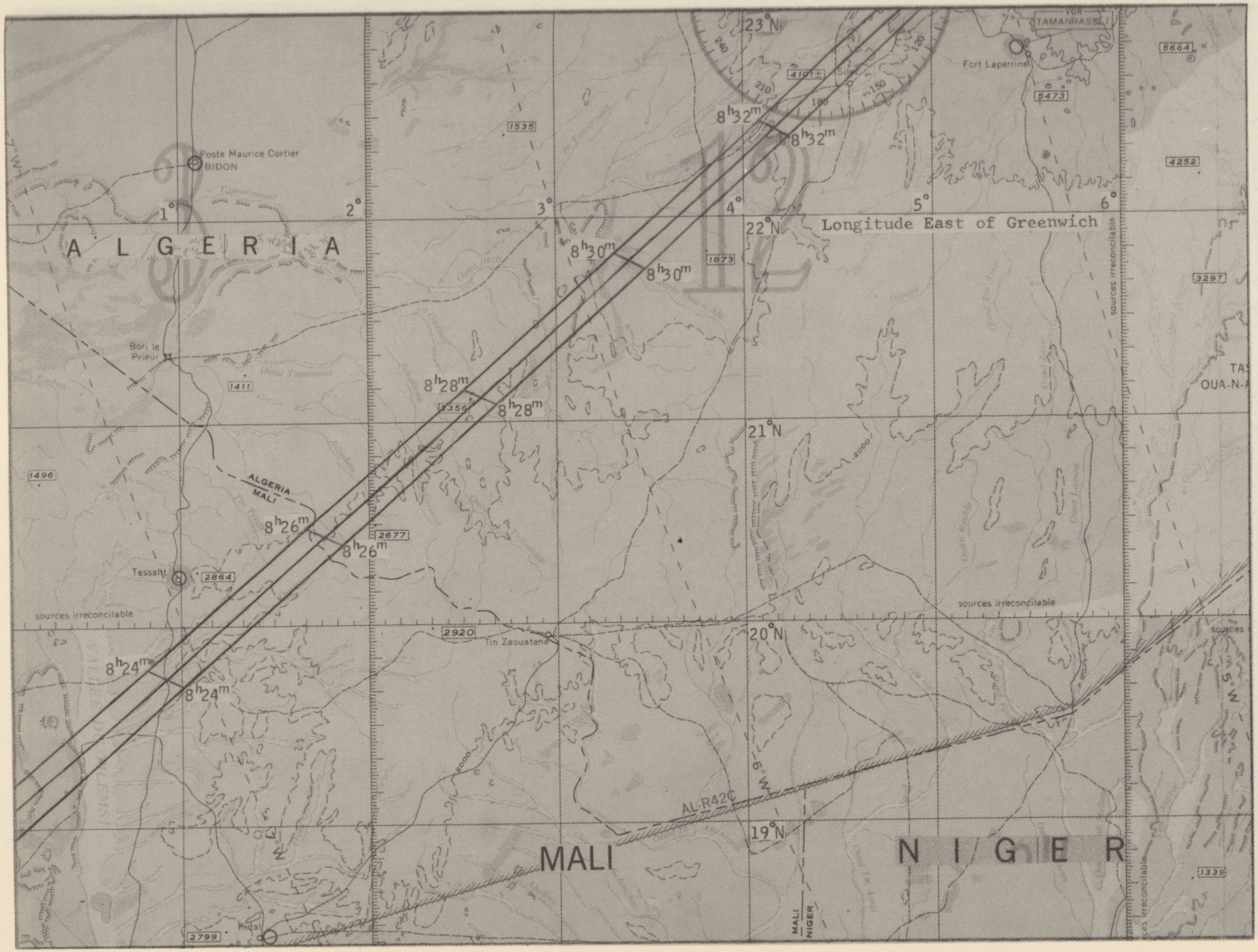
LOCAL CIRCUMSTANCES

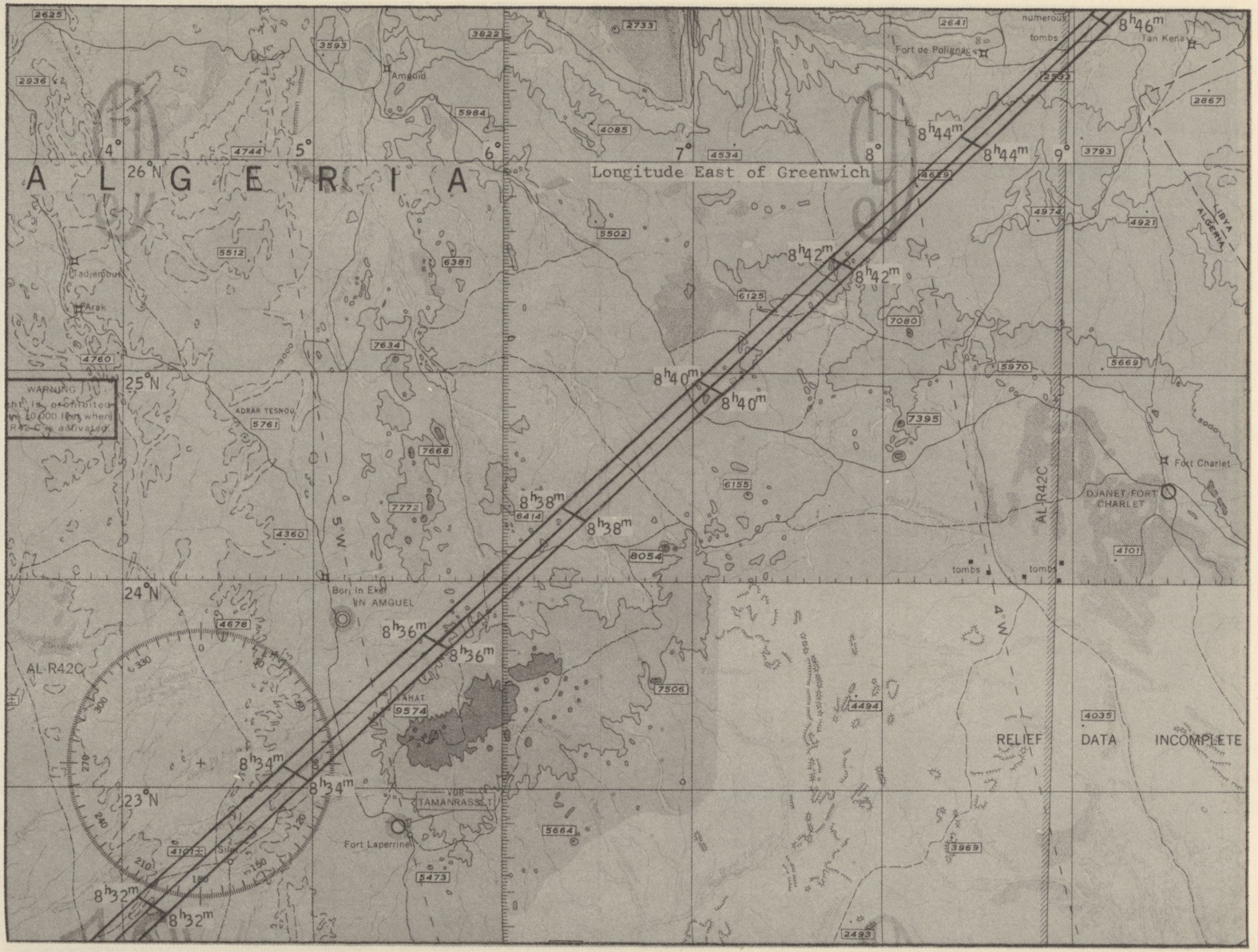
Maximum Eclipse Universal Time	Magnitude	Sun's Alt.	Sun's Az.	Third Contact Universal Time	P	V	Fourth Contact Universal Time	P	V	Duration	Width of Path
h m s		°	°	h m s	°	°	h m s	°	°	m s	mi
8 00 53.3	0.989	19	72	8 01 14.6	61	148	9 10 53.8	58	151	0 42.5	28
7 59 43.9	0.964	19	72				9 09 46.9	56	150		
8 01 46.6	0.990	21	72	8 02 06.8	71	158	9 12 25.1	58	150		
8 02 24.0	0.990	22	73	8 02 42.5	35	122	9 13 35.6	58	150	0 40.5	27
8 03 04.1	0.990	22	73	8 03 23.4	75	162	9 14 37.1	58	150	0 37.0	26
8 03 07.7	0.987	23	73				9 14 59.6	57	150	0 38.6	25
8 05 59.0	0.991	26	74	8 06 17.4	49	135					
8 06 52.7	0.985	27	74				9 19 28.7	57	149	0 35.7	23
8 08 28.4	0.992	28	74	8 08 44.8	80	165	9 21 10.5	56	148		
8 08 43.3	0.992	29	75	8 08 54.5	9	94	9 23 21.4	57	148	0 32.8	21
8 08 51.9	0.978	29	75				9 23 52.4	57	148	0 22.4	21
							9 24 28.6	56	147		
8 14 56.8	0.990	34	77								
8 15 58.1	0.993	35	77	8 16 06.4	113	196	9 33 02.5	57	145		
8 17 10.6	0.940	38	77				9 34 37.3	56	145	0 16.6	17
							9 37 46.6	52	143		
8 24 59.2	0.988	41	81								
8 32 49.1	0.995	47	85				9 47 14.6	56	140		
							9 58 08.2	55	135		
8 35 41.8	0.987	48	86								
8 34 04.0	0.981	48	85				10 01 34.1	56	132		
8 44 56.9	0.991	53	92				10 00 07.1	55	133		
							10 13 26.2	57	121		
8 46 22.9	0.988	55	93								
8 49 24.3	0.979	55	95				10 15 40.4	55	118		
8 49 22.0	0.989	56	95				10 18 36.1	57	114		
							10 18 50.3	57	114		
9 04 08.3	0.940	60	108								
8 59 36.1	0.999	60	104	8 59 39.3	91	155	10 34 43.0	61	86		
9 05 58.2	0.983	62	110				10 31 11.1	57	90	0 06.4	3
9 04 28.6	0.998	62	108				10 37 59.8	59	76		
9 04 57.1	0.984	63	109				10 36 45.9	58	77		
							10 37 39.2	57	73		
9 26 45.2	0.990	68	138								
9 27 17.7	0.997	69	139				11 00 05.5	61	40		
9 29 52.7	0.982	68	143				11 00 55.0	60	38		
9 31 18.5	0.991	69	145				11 02 56.6	62	39		
							11 04 35.4	62	36		
9 43 09.5	0.990	69	166								
9 45 55.4	0.986	69	171				11 15 39.1	63	30		
9 44 57.3	0.991	69	170				11 18 01.1	64	30		
9 46 00.9	0.999	69	171				11 17 41.3	63	27		
9 47 25.2	0.996	69	174				11 18 25.4	63	28		
9 53 11.8	0.990	68	184				11 19 46.1	63	27		
9 52 03.5	0.939	70	185				11 24 54.8	64	25		
							11 24 58.8	61	19		
10 06 43.3	0.977	64	202								
10 08 42.6	0.993	64	207				11 35 15.5	68	28		
10 10 42.7	0.993	63	209				11 37 29.2	67	25		
10 11 02.9	0.999	63	209	10 11 04.3	27	5	11 38 45.7	68	26		
10 12 02.2	0.995	62	210				11 39 09.5	68	25	0 02.7	2
10 12 11.5	0.995	62	211				11 39 48.5	68	26		
10 13 06.8	0.996	62	212				11 40 07.0	68	25		
							11 40 39.6	68	26		
8 58 58.0	0.704	50	104								
11 07 04.1	0.911	32	268				10 18 54.3	75	119		
11 17 38.8	0.152	31	282				12 16 58.3	72	22		
9 45 29.4	0.867	65	165				11 59 35.6	20	303		
10 16 42.5	0.844	64	225				11 13 58.7	71	46		
9 20 20.6	0.751	59	126				11 45 45.8	60	9		
9 42 20.6	0.481	51	148				10 44 43.4	74	85		
9 21 16.6	0.327	42	116				10 50 23.1	95	99		
9 28 05.5	0.325	43	124				10 16 47.2	105	133		
9 20 13.4	0.580	52	123				10 23 37.9	106	128		
9 28 37.0	0.555	53	132				10 35 03.8	86	106		
9 22 27.8	0.434	47	122				10 42 01.5	88	101		
11 07 14.8	0.682	14	284				10 27 04.0	96	120		
11 32 25.4	0.594	2	291				12 04 05.9	96	60		
9 28 37.7	0.460	49	130				.. ..	...	...		
9 43 00.5	0.487	51	149				10 35 20.8	95	112		
8 59 21.0	0.547	44	102				10 51 24.8	95	98		
10 12 32.8	0.680	53	198				10 09 59.0	86	131		
9 20 48.5	0.489	49	122				11 28 46.5	87	61		
9 59 27.6	0.952	65	191				10 29 28.9	92	116		
11 00 38.6	0.829	39	263				11 28 44.1	68	32		
9 26 14.4	0.481	50	127				12 14 24.8	66	13		
							10 34 27.9	93	112		

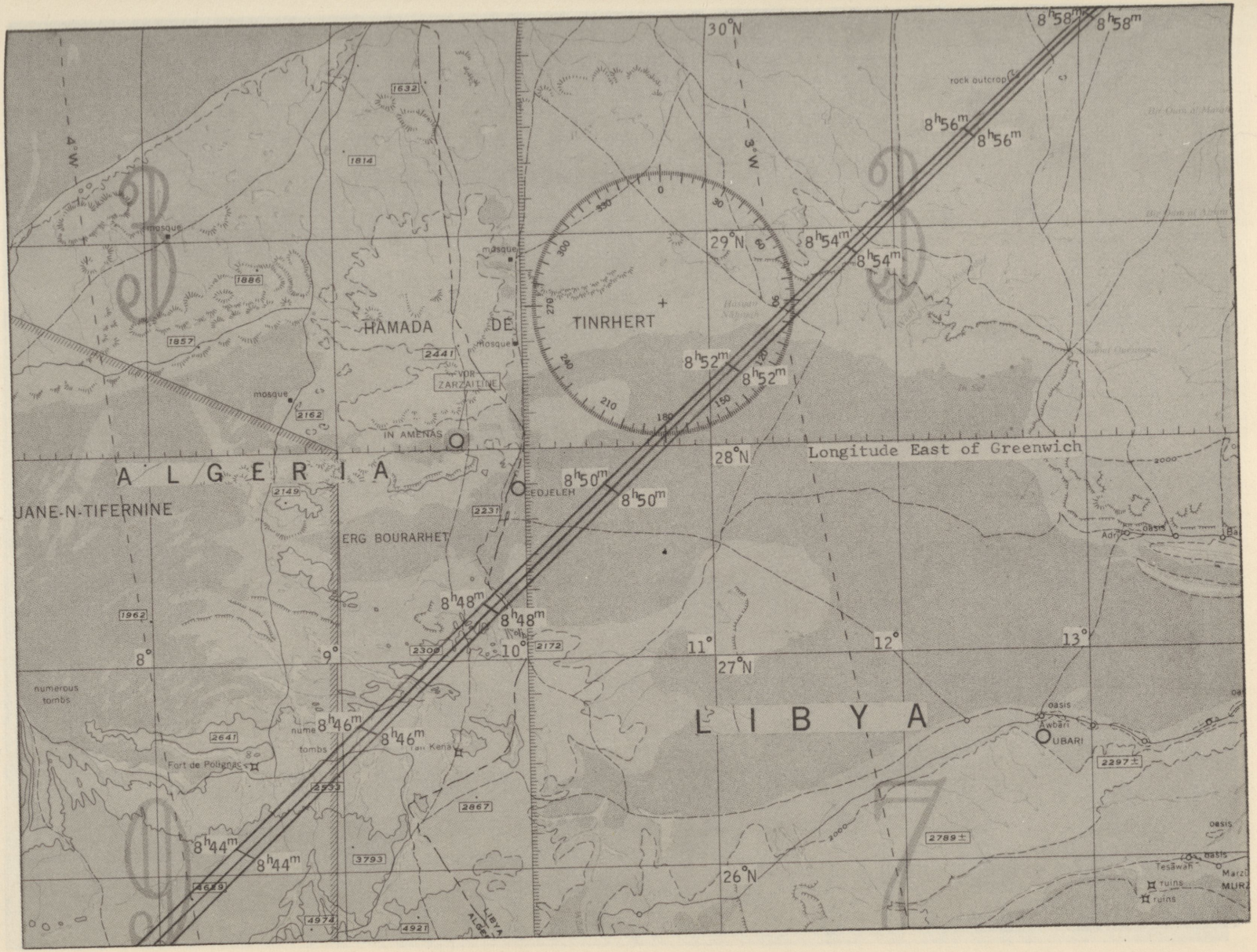

PORTUGUESE GUINEA
GUINEA
GUINEA
SIERRA LEONE
SIERRA LEONE (UK)
ATLANTIC OCEAN
8h04m
8h04m
8h02m
8h02m
8h00m
8h00m
11°N
10°N
9°N
8°N
16°
15°
14°
13°
12°
11°
Longitude West of Greenwich
CONAKRY
Iles De Los
FREETOWN
M. R Bn
FREETOWN
R Bn
LUNGI
FW-D15
Banana Is
Cape Shilling
Turtle Is
Sherbro Is
Bolama
Ilha Formosa
Ilha Uno
Ilha Roxa
Ilha de Orango
Buba
Candembo
Cacine
Baka
VICTORIA
Cap Verga
Bofra
Kambia
Port Loko
Marampa
Waterloo
Makeni
Mamou
Labe
Gaoual
Koumbia
Faranah
Sisséla
Kenema
Koribundu
Bo
Yengema
Liberia
4085
3094
2352
4675
3610
4101
6398
6080
2050
2913
1716
1820
2559

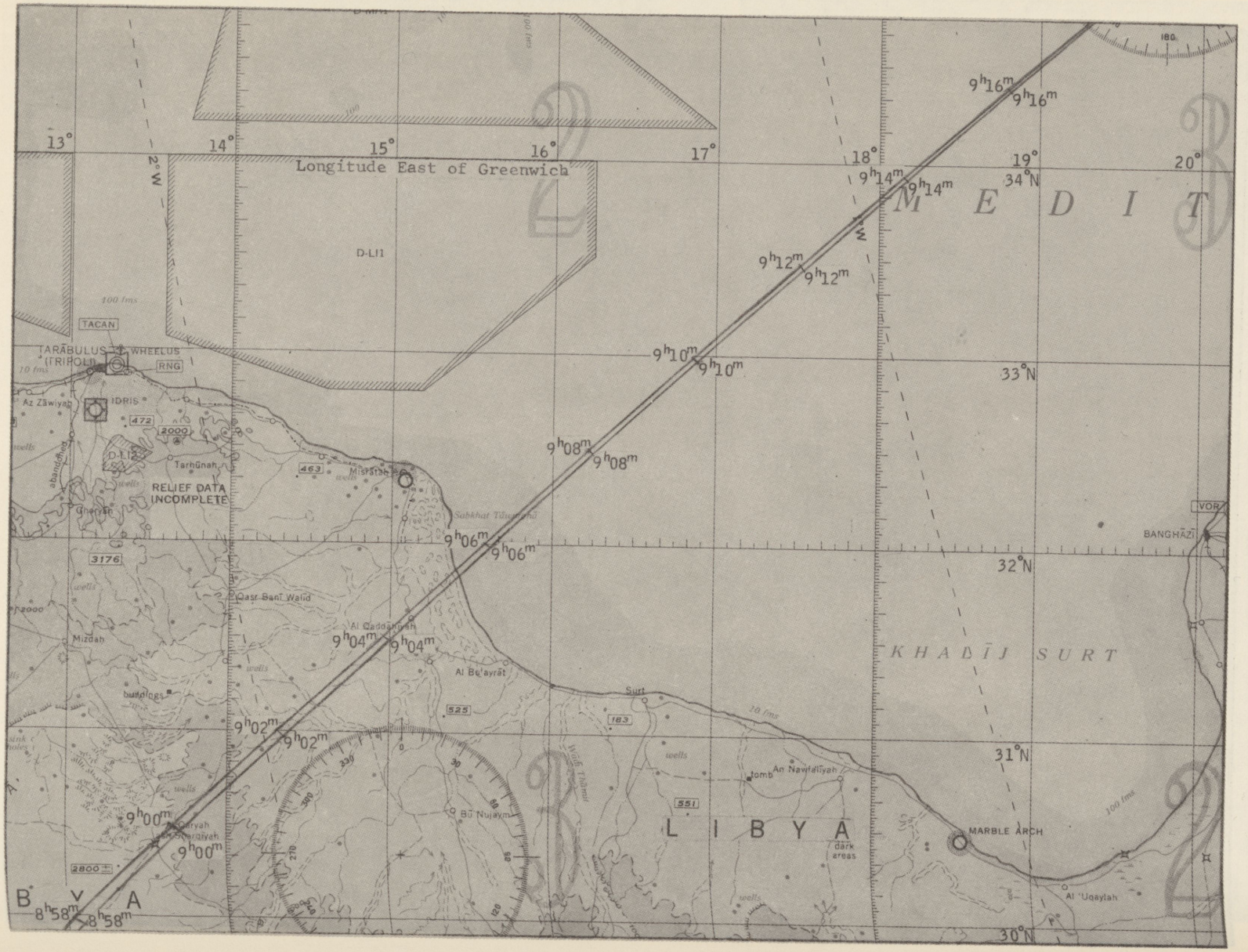

MALI
GUINEA
8h06m
8h08m
8h10m
8h04m
FW-R13
FW-R14
15°N
14°N
13°N
12°N
11°N
10°
9°
8°
7°
6°
5°
11°W
Longitude West of Greenwich
BAMAKO
SEGOU
Goumbou
Monimpebougou
Didiéni
Kolokani
Toukoroba
Mabina
Toskoto
Kita
Sirakoro
Fana
Bla
Sarro
Kangaba
Bougouni
Niena
Sikasso
Kouri
Bouka Were
Siguri
Niandan Koro
Solona
Sanguiana
Sissela
Kouroussa
OM'Pagnat
Kadiana
Orodara
NIGER
MALI


8h22m
8h20m
8h18m
8h16m
8h14m
8h12m
MALI
MAURITANIA
NIGER
Longitude West of Greenwich
0°
1°
2°
3°
4°
5°
6°
19°N
18°N
17°N
16°N
15°N
8°W
Araouane
Bou Diébéha
Erouâ
Marzafet
Bamba
Bourem
GAO
Gourma-Rharous
Inorfâne
Tombouctou
Lac Faguibine
Ras el Ma
Lac Kamangui
Goundam
Lac Horo
Lac Do
Lac Garou
Banzara-Maoudé
Lac Niangaye
Lac Aoboungou
Nguorma
Rounga-Kouara
Lac Rharous
Kabara
Niafunké
Dire
Tin Diriouat
Achérich
Hombori
Douentza
Sandiri
Nampala
Bassikounou
Nouakchott


ALGERIA
MALI
NIGER
Longitude East of Greenwich
23°N
22°N
21°N
20°N
19°N
1°
2°
3°
4°
5°
6°
Poste Maurice Cortier
BIDON
Fort Laperrine
TAMANRASSET
Bordj le Prieur
Tessalit
Tin Zaouatene
Kidal
ALGERIA
MALI
AL-R42C
MALI
NIGER
sources irreconcilable
8h32m
8h30m
8h28m
8h26m
8h24m

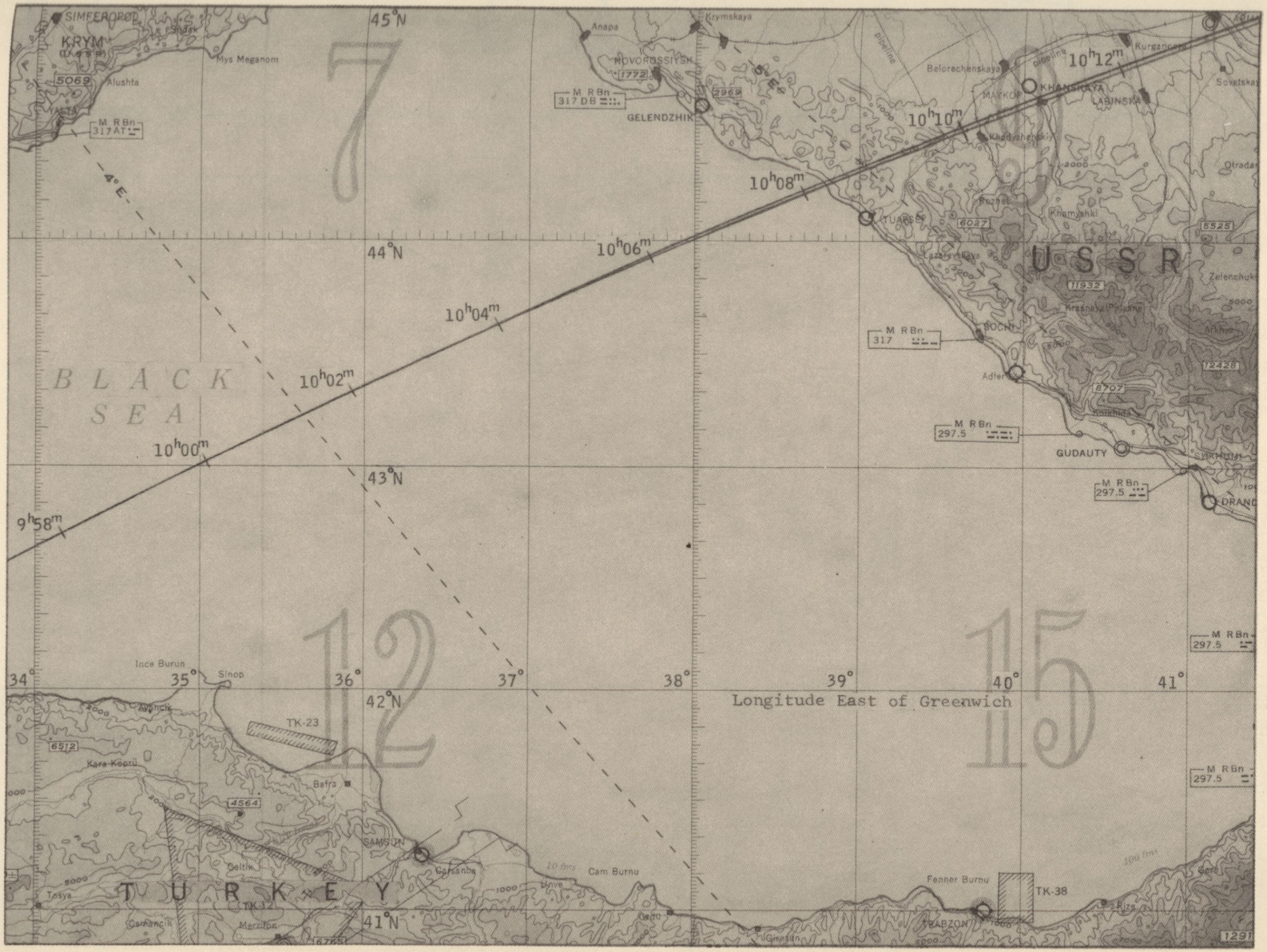

A L G E R I A
Longitude East of Greenwich
4°
5°
6°
7°
8°
9°
26°N
25°N
24°N
23°N
8h46m
8h44m
8h42m
8h40m
8h38m
8h36m
8h34m
8h32m
Tan Kena
Fort de Polignac
numerous tombs
Amguid
Tadjerouit
Arak
ADRAR TESNOU
WARNING
Fort Charlet
DJANET FORT CHARLET
AL R42C
tombs
Bordj In Eker
IN AMGUEL
AHAT
9574
AL R42C
VOR TAMANRASSET
Fort Laperrine
RELIEF DATA INCOMPLETE
LIBYA
ALGERIA

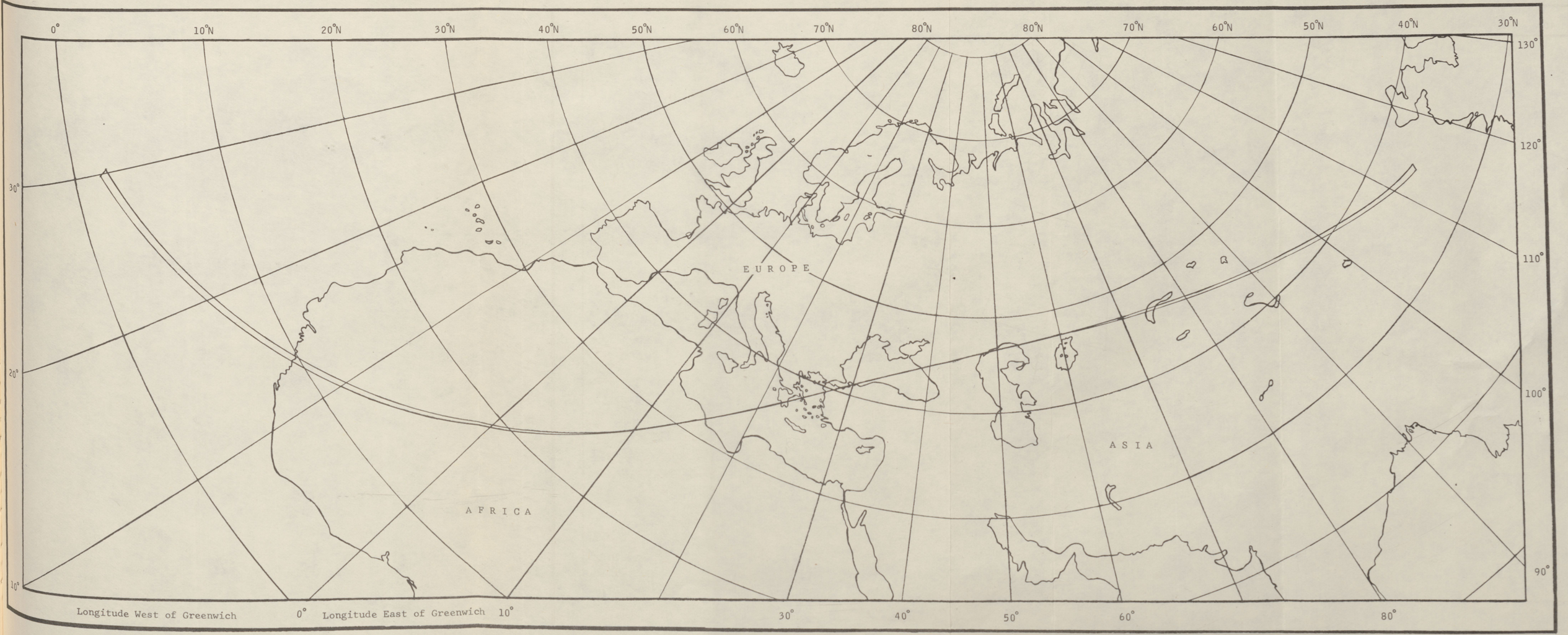

8h58m
8h56m
8h54m
8h52m
8h50m
8h48m
8h46m
8h44m
30°N
29°N
28°N
27°N
26°N
8°
9°
10°
11°
12°
13°
4°W
3°W
Longitude East of Greenwich
HAMADA DE TINRHERT
ALGERIA
LIBYA
IN AMENAS
ERG BOURARHET
JANE-N-TIFERNINE
EOJELEH
UBARI
Awbari
Kena
Fort de Polignac
numerous tombs
mosque
rock outcrop
oasis
Tesawah
ruins
VOR ZARZAITINE


Longitude East of Greenwich
13°
14°
15°
16°
17°
18°
19°
20°
34°N
33°N
32°N
31°N
30°N
M E D I T
KHADĪJ SURT
L I B Y A
TARĀBULUS (TRIPOLI)
WHEELUS
TACAN
RNG
IDRIS
Az Zāwiyah
Tarhūnah
RELIEF DATA INCOMPLETE
Qasr Banī Walīd
Mizdah
Al Qaddāhiyah
Al Bu'ayrāt
Surt
Sabkhat Tāwurgha
BANGHĀZĪ
VOR
An Nawfalīyah
Tomb
MARBLE ARCH
Al 'Uqaylah
Bū Nujaym
dark areas
buildings
wells
100 fms
10 fms
D-L11
D-L12
9h16m
9h14m
9h12m
9h10m
9h08m
9h06m
9h04m
9h02m
9h00m
8h58m
B
A

GREECE
IONIAN SEA
PELOPONNISOS
ÉVVOIA
SCOPELOS
LESVOS
SKÍROS
2598
ANDROS
3271
KÍTHNOS
SÍFNOS
SÉRIFOS
1585
PÁROS
2477
NÁXOS
3284
NÍSOS MÍKONOS
IKARÍA
3422
NÍSOS SÍFNOS
2224
ANDÍMILOS
NÍSOS MÍLOS
2464
MÍLOS
SÍKINOS
IOS
2365
FOLEGÁNDROS
NÍSOS THÍRA
1854
ANÁFI
NÍSIDHES KHRISTIANÁ
KÍTHIRA
1664
ÁKRA MELÉAS
ÁKRA TAÍNARON
ELAFONÍSOS
NÍSOS VELOPOÚLA
745
NÍSOS ANDIKÍTHIRA
1230
SEA OF CRETE
CRETE
SOUDHA
KHANIÁ
IRÁKLION
RÁSTELLION
8058
7047
8045
AKRA SPATHA
TACAN
ÁKRA LÍTHINON
NÍSOS GÁVDHOS
1066
NÍSÍS KHRISÍ
NÍSÍS AVGÓ
KOUFONÍ
OUNIANÍS
ASTIPÁLAI
1581
KEFALLINÍA
5342
ITHAKI
2638
LEVKÁS
3800
ZÁKINTHOS
2480
D-GR 106
D-GR 130
NÍSOI STROFÁDHES
NÍSÍS PRÓTI
NÍSÍS SAPIÉNTZA
NÍSOI OINOÚSAI
ARAXOS
ANDRAVÍDHA
KYPARISSIAKÓS KÓLPOS
LAKONIKÓS KÓLPOS
PATRAÏKÓS KÓLPOS
ANTIKÍTHIRA STRAIT
Longitude East of Greenwich
19°
20°
21°
22°
23°
24°
25°
26°
39°N
38°N
37°N
36°N
35°N
9h38m
9h36m
9h34m
9h32m
9h30m
9h28m
9h26m
9h24m
9h22m
9h20m
9h18m

BLACK SEA
SEA OF MARMARA
TURKEY
Longitude East of Greenwich
27°
28°
29°
30°
31°
32°
33°
43°N
42°N
41°N
40°N
39°N
9h56m
9h54m
9h52m
9h50m
9h48m
9h46m
9h44m
9h42m
9h40m
BURGAS
Nos Emine
Igneada Burnu
Kirklareli
Lüleburgaz
Tekirdağ
Çorlu
İSTANBUL
ÜSKÜDAR
YESILKOY
Sile
Kesan
Marmara Adasi
YALOVA
ADAPAZARI
Düzce
Bolu
Bafra Burnu
Bartin
Cide
Inebolu
Azdavay
Kastamonu
Gerede
Hamamli
Korsunlu
Cankiri
Kizilcahamam
ANKARA
Kalecik
Ayas
Sariyar Dami
ESKISEHIR
Power station
ETIMESGUTANKARA
Polatli
GOLBASI
Haymana
Kulu
Karapinar
Karabiyik
AFYON
BURSA
ÇANAKKALE
Biga
Bergama
Kütahya
Simav
Gediz
Usak
Afyon
Karaagil
Bala
Kirikkale
TK-17-18
TK-41
TK-5
D-17
D-19
R-3
R-4
R-7
P-3
P-4
P-5


SIMFEROPOL
KRYM
Mys Meganom
Alushta
5069
M R Bn 317 AT
Anapa
NOVOROSSIYSK
1772
M R Bn 317 DB
GELENDZHIK
2969
Krymskaya
Belorechenskaya
MAYKOP
KHANSKAYA
LABINSKA
Kurganinsk
Sovetskaya
Otradnaya
Khadyzhenskiy
Khamyshki
6027
5525
Tuapse
USSR
11932
Krasnaya Polyana
SOCHI
M R Bn 317
Adler
12426
6707
M R Bn 297.5
GUDAUTY
Sukhumi
M R Bn 297.5
M R Bn 297.5
M R Bn 297.5
Ince Burun
Sinop
Ayancik
TK-23
6512
Kara-Koprü
Bafra
4564
SAMSUN
Çarşamba
Cam Burnu
Fener Burnu
TK-38
TRABZON
Rize
1291
T U R K E Y
TK-32
Tosya
Çerkeş
Merzifon
6765
Gresun
BLACK SEA
45°N
44°N
43°N
42°N
41°N
34°
35°
36°
37°
38°
39°
40°
41°
Longitude East of Greenwich
4° E
9h58m
10h00m
10h02m
10h04m
10h06m
10h08m
10h10m
10h12m


0°
10°N
20°N
30°N
40°N
50°N
60°N
70°N
80°N
80°N
70°N
60°N
50°N
40°N
30°N
130°
120°
110°
100°
90°
30°
20°
10°
EUROPE
AFRICA
ASIA
Longitude West of Greenwich
0°
Longitude East of Greenwich
10°
30°
40°
50°
60°
80°